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Geochemical Prospecting*

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Until a few years ago, geological mapping of rock formations and structure on the surface, subsurface information from bore holes and mines, and geophysical methods were the principal means used in the systematic search for mineral deposits covered by a mantle of soil and other products of weathering. The use of geophysical methods in prospecting is based on the principle that an ore body differs from the country rock in physical properties. Geophysical methods involve the measurement of certain physical anomalies or irregularities, in magnetic, electrical, gravitational and radioactive properties, which may serve to suggest ore deposits or structures favorable to such deposits.

Geophysical methods have been successfully employed in the direct location of certain ores, such as those of iron, massive sulfides, uranium, etc. However, geophysical "anomalies" frequently have non-ore causes, such as magnetic igneous rocks, conductive shear zones, and graphite zones. Also, many ores such as those of silver, gold, cobalt, nickel, etc. cannot be located directly by these methods because of the lack of distinctive physical contrasts. Thus efforts have been made to develop direct chemical methods for prospecting and locating ore bodies of many common metals. The geochemical methods make it possible, under favorable conditions, to determine what metals the deposit contains as well as something about their concentration.

Chemical Prospecting Methods

Ore deposits are usually surrounded by a metal content anomaly or dispersion halo in which the ore-metal concentration is intermediate between that of the ore and that of the unmineralized country rock. Dispersion halos are of two types: One, the primary dispersion halo, is genetically related to the ore mineralization and occurs in the unweathered country rock surrounding or overlying the ore. The primary dispersion halo may possess a variety of shapes and the intensity of its development may vary within wide limits, even for similar-appearing ore deposits. The other type of dispersion halo is known as a secondary dispersion pattern, and may be present in the rock disintegration products--the soil or partially decomposed rock fragments, stream sediments, and dissolved salts in ground and surface water that are derived from the weathering and erosion of the ore and any associated primary halo.

Secondary dispersion halos or patterns can be further classified as those occuring in residual overburden at the site of the ore deposit (*leached ore outcrops and gossans*), those occuring in mechanically transported overburden at varying distances from the actual ore deposit (*glacial till, talus falls, soil flows and slides*), those occuring in drainage sediments (*stream bed and flood plain sediments, lake sediments, etc.*) and those found in natural waters, either ground water or surface stream water and lakes.

Field tests for prospecting purposes must sacrifice a certain amount of accuracy in order to gain speed, ease of manipulation, and portability of equipment. Field tests are usually devised so that they are either specific for a certain metal or nonspecific so that they will give a positive reaction with any of a group of ore metals. Specific tests leave no doubt concerning the identity of the metal giving a positive test; also, they permit the distribution pattern of each metal to be studied separately. Nonspecific tests are especially useful in eliminating unnecessary sampling of a barren area.

Of the various techniques of determining the concentration of heavy metals, colorimetry seems to offer

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